

NSF CROSSCUTTING INVESTMENT STRATEGIES

This section contains a partial listing of cross-directorate programs sponsored by the National Science Foundation (NSF). Activities not mentioned here may appear elsewhere in this site. Refer to the appropriate directorate. All fields of science and engineering supported by NSF are eligible for consideration and support by these programs.

- [NSF Priority Areas](#)
- [Human Resource and Career Development](#)
- [Crosscutting Research, Instrumentation, and Partnering Programs](#)



For More Information

Visit the NSF Crosscutting Programs home page,
<http://www.nsf.gov/home/crssprgm/>.

NSF CROSSCUTTING INVESTMENT STRATEGIES

NSF Priority Areas

The National Science Foundation's (NSF) investments in priority areas are focused on frontiers of knowledge, where discovery and innovation are likely to produce significant progress. NSF works with other government agencies to identify and support these multidisciplinary areas.

The priority areas that NSF has selected for significant investment during the next several years are:

1. [Biocomplexity in the Environment](#)
2. [Information Technology Research](#)
3. [Workforce for the 21st Century](#)
4. [Nanoscale Science and Engineering](#)
5. [Mathematical Sciences](#)
6. [Human and Social Dynamics](#)

The priority areas in this section address NSF's three strategic goals:

1. **People**—A diverse, internationally competitive and globally engaged workforce of scientists, engineers, and well-prepared citizens.
2. **Ideas**—Discovery at and across the frontier of science and engineering, and connections to its use in the service of society.
3. **Tools**—Broadly accessible, state-of-the-art, and shared research and educational tools.

1. Biocomplexity in the Environment

The environment is a subject of profound national importance and scientific interest, making it a strategic priority for NSF. The goals of NSF's investment in this area include enhancement of fundamental environmental research in all relevant disciplines and in interdisciplinary and long-term research; creation of educational opportunities that build scientific and technological capacity; discovery of innovative methods that avoid environmental harm and inform the decision-making process; and support for advanced physical, technological, informational, and international infrastructure.

A centerpiece of NSF's Environmental Research and Education portfolio is the Biocomplexity in the Environment (BE) competition. Initiated in fiscal year (FY) 1999, this special competition promotes comprehensive, integrated investigations of environmental systems using advanced scientific and engineering methods.

Biocomplexity refers to the dynamic web of interrelationships that arise when living things at all levels--from molecular structures to genes to organisms to ecosystems--interact with their environment. Investigations of biocomplexity in the environment are intended to provide a more complete and synthetic understanding of natural processes, human behaviors and decisions in the natural world; and ways to use new technology effectively to observe the environment and sustain the diversity of life on Earth. By placing biocomplexity studies in an environmental context, the Biocomplexity in the Environment competition emphasizes research with the following characteristics: highly interdisciplinary; explicit consideration of nonhuman biota and humans; and focus on challenging systems with high potential for exhibiting nonlinear or highly coupled behavior.

Five interdisciplinary areas will be emphasized again in FY 2003:

- **Dynamics of Coupled Natural and Human (CNH) Systems**—Emphasizes quantitative interdisciplinary analysis of relevant human and natural systems processes and the complex interactions among human and natural systems at diverse scales, with special emphasis given to studies of natural capital; landscapes and land use; and uncertainty, resilience, and vulnerability.
- **Coupled Biogeochemical Cycles (CBC)**—Focuses on the interrelation of biological, geochemical, geological, and physical processes at all temporal and spatial scales, with particular emphasis on understanding linkages between chemical and physical cycles and the influence of human and other biotic factors on those cycles.
- **Genome-Enabled Environmental Science and Engineering (GEN-EN)**—Encourages the use of genetic and information technology approaches to gain novel insights into environmental questions and problems.
- **Instrumentation Development for Environmental Activities (IDEA)**—Supports the development of instrumentation and software that relies on and takes advantage of microelectronics, photonics, telemetry, robotics, sensing systems, modeling, data mining, and analysis techniques to bring recent laboratory instrumentation advances to bear on the full spectrum of environmental biocomplexity questions.
- **Materials Use: Science, Engineering, and Society (MUSES)**—Supports projects directed toward reducing adverse human impact on the total interactive system of resource use; designing and synthesizing new materials with environmentally benign impacts on biocomplex systems; and maximizing the efficient use of individual materials throughout their life cycles.



For More Information

The current program solicitation is [NSF 02-167](#). Information is also available at the NSF Environmental Research and Education web site, <http://www.nsf.gov/ere/>. Additional information on anticipated multidisciplinary BE-related activities in microbial genome sequencing, carbon and water cycling, social adaptation to hazards, and geomicrobiology will be posted on the web site.

2. Information Technology Research (ITR)

Sustained leadership in the United States in information technology requires an aggressive federal program to create new knowledge in a variety of areas. The U.S. economy's robust growth has resulted in part from new ideas that became the basis for new products. For example, NSF contributed greatly to the development of today's Internet. NSF's investments—in ideas, people, and tools—have benefited greatly from the application of information technology.

NSF faces two major challenges and opportunities with respect to information technology. The first challenge is to support the people, ideas, and tools that will create and advance knowledge in all areas of information science and engineering. Wholly new computational approaches are needed for problems arising from the science and engineering disciplines and the development of new learning technologies for use in education.

The second challenge is to upgrade the computational and computing infrastructures for all fields that NSF supports. Researchers and educators in many areas need to incorporate information technology and, in some cases, revolutionize their experimental and collaborative processes to attain new effectiveness and greater efficiency. In addition, the United States must address a range of access and workforce issues. Overcoming inequities will require innovative educational technologies, such as highly interactive computer science courseware that is both multicultural and multimedia.

NSF is the lead agency for a multiagency 5-year research initiative in information technology. Each agency participating in the initiative will define specific programs in keeping with that agency's mission. NSF is primarily responsible for basic research to advance knowledge and for education and workforce development activities. The multiyear Information Technology Research investment by NSF will lead to the following outcomes:

- Advancement of fundamental knowledge in techniques for computation, the representation of information, the manipulation and visualization of information, and the transmission and communication of information.
- Enhanced knowledge about how to design, build, and maintain large, complex software systems that are reliable, predictable, secure, and scalable.
- New knowledge about distributed and networked systems and interactions among component parts, as well as the interaction of systems with both individuals and cooperating groups of users. Such networks can empower a broadly distributed scientific community to participate fully in frontline research.
- Development of a significantly advanced high-end computing capability needed to solve myriad important science and engineering problems.
- Increased understanding of the societal, ethical, and workforce implications of the information revolution.
- A strong information technology workforce and a citizenry capable of using information technology effectively.



For More Information

Visit the ITR web site at <http://www.itr.nsf.gov/>.

3. Workforce for the 21st Century

Continued U.S. leadership in the global economy is dependent on the availability of a diverse science, technology, engineering, and mathematics (STEM) workforce. As technological advances radically change workplace environments, the workforce at large will require new skills, including higher education degrees of problem solving ability, quantitative computer and communications literacy, and increased competencies in STEM. This priority area focuses on generating the base of knowledge that will support effective research-based pedagogies that will address these higher order skills, advancing curriculum and faculty development, integrating research and education programs, and embedding diversity throughout.

Fiscal year 2003 areas of emphasis include:

- **Workforce Research**—Investments in determining the experiences and strategies that are most effective in attracting and retaining students in careers that require competence in STEM.
- **Learning Tools**—Research, development, and testing of information technology-based tools that facilitate learning across many levels of formal and informal education for both individuals and groups. New communication and information technologies show promise to enhance the delivery of education and offer the possibility of providing truly learner-centered, independent learning environments over an entire lifetime and at any convenient place and time.
- **Creating Connections**—Activities create connections across levels of formal education and workforce development and provide mechanisms to bridge gaps between educational layers.
- **Centers for Learning and Teaching (CLT)**—Activities that link K-12 and higher education to

provide lifelong learning opportunities for the instructional workforce in contexts supported by information technology tools and by research on learning, science, and mathematics. CLTs will address the need to increase the quality of research on learning and teaching, to develop the next generation of science and mathematics education specialists, and to strengthen the competencies of the preK-12 instructional workforce.

4. Nanoscale Science and Engineering

Nanoscale science and engineering promises to produce a dominant technology for the 21st century. Control of matter at the nanoscale level underpins innovation in critical areas from information and medicine to manufacturing and the environment.

One nanometer (one billionth of a meter) is a magical point on the dimensional scale. Nanostructures are at the confluence of the smallest of human-made devices and the largest molecules of living systems. Biological cells such as red blood cells have diameters in the range of thousands of nanometers. Micro systems with nanoscale components are now approaching this same scale. This means we are now at the point of connecting machines to individual cells.

Sixteen federal agencies have joined together to promote advances in nanotechnology. NSF has the largest investment. NSF's nanoscale science and engineering program is a multiyear investment whose goals include the following:

- discovery of novel phenomena, material structures, processes, and tools;
- enhanced methods for the synthesis and processing of engineered, nanometer-scale building blocks for materials and system components;
- new device concepts and system architecture appropriate to the unique features and demands of nanoscale engineering;
- manufacturing and environmental processes at the nanoscale;
- development of a new generation of skilled workers who have the multidisciplinary perspective necessary for rapid progress in nanotechnology;
- increased understanding of societal, ethical, and workforce implications of nanoscience and nanotechnology; and
- convergence of nano-, bio-, information, and cognition-based technologies.



For More Information

See the latest program solicitation, available on the Nanoscale Science and Engineering Program web site, <http://www.nsf.gov/nano/>.

5. Mathematical Sciences

Today's discoveries in science, engineering, and technology are inextricably intertwined with advances across the mathematical sciences, which provide both powerful tools for insight and a common language for science and engineering. Underlying recent progress in such areas as genomics, information technologies, and climate science are new mathematical and statistical tools that enable scientists and engineers to tackle a broad range of scientific and technological challenges long considered intractable. NSF has proposed a priority area in the Mathematical Sciences that will begin in fiscal year 2003. The goal of this priority area is to advance frontiers in three interlinked areas:

- fundamental mathematical and statistical sciences;
- interdisciplinary research involving the mathematical sciences with science and engineering; and
- critical investments in mathematical sciences education.

Fundamental research themes cut across all areas of the mathematical and statistical sciences. To enhance research in these areas, NSF will provide support through focused research groups, individual investigator grants, and institute and postdoctoral training activities.

The success of the mathematical sciences in producing new analytical, statistical, and computational tools has increased the demand both for further development of new tools and for research teams capable of applying these techniques. A new cadre of researchers who are broadly trained is needed to tackle the increasingly complex **interdisciplinary research** topics that confront society. Three broad research themes have been identified for initial emphasis:

- **Mathematical and Statistical Challenges Posed by Large Data Sets**—Challenges arise in such areas as large genetic databases; the explosion of data from satellite observation systems, seismic networks, global oceanic and atmospheric observational networks, and large astronomical surveys; situations in which privacy and missing data are major concerns; massive data streams generated by automated physical science instruments; and data produced by modern engineering systems.
- **Managing and Modeling Uncertainty**—Predictions of phenomena, with measures of uncertainty, are critical for making decisions in areas from public policy to research. Challenges include improving methods for assessing uncertainty and enhancing our ability to forecast extreme or singular events, thus increasing the safety and reliability of such systems as power grids, the Internet, and air traffic control. Other applications include forecasting the spread of an invasive species, predicting genetic change, evaluating the likelihood of complex climate change scenarios, and improving the utility of forecasts of market behavior.
- **Modeling Complex Nonlinear Systems**—Advances in mathematics are necessary for a fundamental understanding of the mechanisms underlying interacting complex systems and will be essential for further development of modern physical theories of the structure of the universe at the smallest and largest scales. Challenges include the analysis and prediction of emergent complex properties from social behaviors to brain function, and from communications networks to multi-scale business information systems.

NSF support in this area will encompass interdisciplinary focused research groups, interdisciplinary programs that link innovative training activities with research, and partnership activities with other federal agencies.

Education efforts will focus on innovative projects centered on these research agenda. Activities in this context will include teacher preparation and professional development, curriculum development, and research on how mathematics is learned. Investments will include support for undergraduate and graduate education as well as postdoctoral training coupled with curriculum reform.



For More Information

A program announcement soliciting proposals in the Mathematical Sciences priority multidisciplinary area will be announced on the Division of Mathematical Sciences web site, <http://www.nsf.gov/mps/dms/>.

6. Human and Social Dynamics

Uncertainty and change have become inescapable facts of life for people today. Economic, social, technological, and environmental change provide new opportunities as well as major challenges. Understanding the human and social dynamics of change in our contemporary world is essential for our nation's continued progress. Multi-scaled, multi-disciplinary approaches, many of which have been

made possible by recently acquired knowledge and new technologies, can bring about this understanding.

To address contemporary problems and to advance fundamental knowledge and the welfare of the nation, the National Science Foundation will develop and apply these approaches through a new Human and Social Dynamics (HSD) priority area. This priority area seeks to (1) better understand the causes and ramifications of change; (2) increase our collective ability to anticipate the complex consequences of change; (3) better understand the dynamics of behavior and the human mind; (4) better understand the cognitive and social structures that create and define change; and (5) help people and organizations better manage profound or rapid change.

The goals of the HSD priority area are:

- to develop a comprehensive, multi-disciplinary approach to understanding human and social dynamics;
- to exploit the convergence in biology, engineering, information technology, and cognition to advance the understanding of behavior and performance at both the individual and social levels;
- to refine knowledge about decision making, risk, and uncertainty and to learn how to translate this knowledge into improved decision making;
- to develop the broad range of infrastructure needed to support transformative interdisciplinary research; and
- to create relevant large-scale data resources and advance methodological frontiers, such as agent-based modeling, complex network analysis, non-linear dynamics, computer-assisted qualitative analysis, multi-level, multi-scalar analysis, and measurement research and technologies.

HSD will be developed over the next five years, with the involvement of all of NSF's directorates. To prepare for the full development of HSD, the Directorate for Social, Behavioral, and Economic Sciences will conduct three special competitions during fiscal year 2003 (FY 03). NSF expects that a broader range of competitions will be conducted in later fiscal years.

Three interdisciplinary areas will be emphasized and supported during the FY 03 competition pending availability of funds. These areas are:

- Climate Change Research Initiative—Decision Making Under Uncertainty (DMUU);
- Enhancing Human Performance (EHP); and
- Empirical Implications of Theoretical Models (EITM).



For More Information

Further information about HSD and the HSD FY 03 special competition is available on the Directorate for Social, Behavioral, and Economic Sciences web site, <http://www.nsf.gov/sbe/hsd/>.

NSF CROSSCUTTING INVESTMENT STRATEGIES

Human Resource and Career Development

Among NSF's crosscutting investments are programs directed to the development of a diverse, internationally competitive, and globally engaged workforce of scientists, engineers, and well-prepared citizens. This section of the Guide highlights programs for human resource and career development that are supported as NSF-wide, as well as specific crosscutting programs of the Directorate for Education and Human Resources (EHR).

NSF sponsors a number of activities directed specifically at bringing members of underrepresented groups into the science and engineering education pipeline and preparing them for potential advancement to the highest levels of leadership. These activities are among those described in this section.

To locate programs that pertain specifically to underrepresented groups, see [Programs for Groups Underrepresented in Science and Engineering](#).

One of the Foundation's goals is to promote a science and engineering workforce that is globally engaged. To help meet this goal, the Office of International Science and Engineering offers a variety of programs. For further information, visit the Office of International Science and Engineering web site, <http://www.nsf.gov/sbe/int/>.

The programs and activities described in this section are organized in the following categories:

- [Programs at the Undergraduate Level](#)
- [Programs at the Graduate and Postdoctoral Level](#)
- [Specialized Programs](#)
- [Programs for Faculty and Institutional Development](#)
- [Programs for Groups Underrepresented in Science and Engineering](#)



For More Information

For further information about programs for human resource and career development, visit the NSF Crosscutting Programs home page, <http://www.nsf.gov/home/crssprgm/>.

For further information about programs managed by the EHR Directorate, including programs for underrepresented groups, visit the following EHR Division home pages:

- Division of Human Resource Development, <http://www.ehr.nsf.gov/ehr/hrd/>
- Division of Undergraduate Education, <http://www.ehr.nsf.gov/ehr/duel/>
- Division of Graduate Education, <http://www.ehr.nsf.gov/ehr/dge/>

• Programs at the Undergraduate Level

Activities to enhance undergraduate education in science and engineering are supported throughout NSF. In particular, the Division of Undergraduate Education (DUE) in EHR offers focused programs for the education of technologists, primarily through community colleges, and for the education of future teachers. On a broader scale, DUE supports course, curriculum, and laboratory improvement aimed at all undergraduate students, both nonmajors and majors, in science and engineering. In addition, some of NSF's disciplinary directorates offer programs in support of course development. Information on these can be found in the directorate sections of this Guide.

NSF is committed to the education of a science and engineering workforce drawn broadly from the Nation's talent pool. To increase diversity at the undergraduate level, NSF offers the **Louis Stokes Alliances for Minority Participation Program**.

To provide opportunities for participation in research, NSF supports the **Research Experiences for Undergraduates (REU) Program**.

The REU Program supports active research participation by undergraduate students in science and engineering disciplines supported by NSF. REU projects involve students in meaningful ways in ongoing research and education programs or in projects specially designed for the purpose. Two support mechanisms are offered: REU Supplements and REU Sites. REU Supplements may be included in proposals for new or renewal NSF grants or as supplements to ongoing NSF-funded projects. REU Sites are based on independent proposals to initiate and conduct undergraduate research and education projects for a number of students. REU Sites projects may be based within a single discipline or academic department or be based on interdisciplinary or multiple-department research opportunities with a strong intellectual focus. Proposals with an international dimension are welcomed. Undergraduate student participants supported with NSF funds in either Supplements or Sites must be citizens or permanent residents of the United States or its possessions.



For More Information

NSF program announcement [NSF 02-136](#), a list of contact people, a list of current REU Sites, and other guidance are available on the REU web site, <http://www.nsf.gov/home/crssprgm/reu/>.

• Programs at the Graduate and Postdoctoral Level

NSF is a major supporter of graduate and postdoctoral education in science and engineering. The majority of this support is embedded in awards to institutions through funds to support graduate research assistants and postdoctoral associates. NSF also supports fellowships and traineeships in the following programs:

Graduate Research Fellowships*

- [Graduate Research Fellowships*](#)
- [Integrative Graduate Education and Research Traineeship \(IGERT\) Program*](#)
- [NSF Graduate Teaching Fellows in K-12 Education*](#)

*Note: Graduate students supported as Fellows or Trainees in these programs must be citizens or permanent residents of the United States or its possessions.

- NSF is committed to the education of a science and engineering workforce drawn broadly from the Nation's talent pool. To increase diversity at the graduate level and beyond, NSF offers the Alliances for Graduate Education and the Professoriate Program

Postdoctoral Fellowships

In addition to supporting postdoctoral associates through NSF research awards to institutions, NSF offers a number of postdoctoral fellowship programs in specific disciplines.

For More Information

A complete list of NSF postdoctoral fellowship programs, including contact names, brief program descriptions, links to program announcements, and other helpful information is available on the NSF FastLane System, https://www.fastlane.nsf.gov/jsp/homepage/postdoc_fel.jsp. The following table also lists current postdoctoral fellowship programs and contact information.

Fellowship	Contact
Minority Postdoctoral Research Fellowships in Biological, Social, Behavioral, and Economic Sciences (NSF 00-139)	<ul style="list-style-type: none"> • BIO Minority Research Fellowships Biological Infrastructure National Science Foundation 4201 Wilson Blvd., Rm 615 Arlington, VA 22230 Tel: 703-292-8470 http://www.nsf.gov/sbe/ses/cda/ • SBE Minority Research Fellowships Cross-Directorate Activities National Science Foundation 4201 Wilson Blvd., Rm 995 Arlington, VA 22230 Tel: 703-292-8763 http://www.nsf.gov/sbe/ses/ip/
Postdoctoral Research Fellowships in Interdisciplinary Informatics: Bridging Biology with the Mathematical Sciences (program announcement in progress)	Postdoctoral Research Fellowships in Biological Informatics Biological Infrastructure National Science Foundation 4201 Wilson Blvd., Rm 615 Arlington, VA 22230 Tel: 703-292-8470 http://www.nsf.gov/bio/dbi/dbitraining.htm

Postdoctoral Research Fellowships in Microbial Biology (NSF 99-142)	Postdoctoral Research Fellowships in Microbial Biology Biological Infrastructure National Science Foundation 4201 Wilson Blvd., Rm 615 Arlington, VA 22230 Tel: 703-292-8470 http://www.nsf.gov/bio/dbi/dbitraining.htm
CISE Postdoctoral Research Associates in Experimental Computer Science (NSF 97-169) (NOTE: A revised announcement is expected to be released in FY 03)	Division of Experimental and Integrative Activities National Science Foundation 4201 Wilson Blvd., Rm 1160 Arlington, VA 22230 Tel: 703-292-8980 http://www.cise.nsf.gov/eia/
Mathematical Sciences Postdoctoral Research Fellowships (with Research Instructorship option) (NSF 01-126) Mathematical Sciences University/Industry Postdoctoral Research Fellowships	Infrastructure Program Division of Mathematical Sciences National Science Foundation 4201 Wilson Blvd., Rm 1025 Arlington, VA 22230 Tel: 703-292-8870 e-mail: msprf@nsf.gov http://www.nsf.gov/mps/divisions/dms/
Graduate Student Industrial Fellowship Postdoctoral Industrial Fellowship	Dr. Donald Senich Division of Design, Manufacture, and Industrial Innovation National Science Foundation 4201 Wilson Blvd., Rm 527 Arlington, VA 22230 Tel: 703-292-8330
Ridge Interdisciplinary Global Experiments (RIDGE 2000) Postdoctoral Fellowships (NSF 02-011)	Division of Ocean Sciences National Science Foundation 4201 Wilson Blvd., Rm 725 Arlington, VA 22230 Tel: 703-292-8580 http://www.nsf.gov/pubs/2002/nsf02011/nsf02011.html
NSF Astronomy and Astrophysics	Division of Astronomical Sciences National Science Foundation

Postdoctoral Fellowships (NSF 00-136)	4201 Wilson Blvd., Rm 1045 Arlington, VA 22230 Tel: 703-292-8820 e-mail: aapf@nsf.gov
MPS Distinguished International Postdoctoral Research Fellowships (NSF 01-154)	<ul style="list-style-type: none"> • Division of Astronomical Sciences Rm 1045; Tel: 703-292-8820 • Division of Chemistry Rm 1055; Tel: 703-292-8840 • Division of Materials Research Rm 1065; Tel: 703-292-8810 • Division of Mathematical Sciences Rm 1025; Tel: 703-292-8870 • Division of Physics Rm 1015; Tel: 703-292-8890 <p>National Science Foundation 4201 Wilson Blvd. Arlington, VA 22230</p>
NSF-NATO Postdoctoral Fellowships in Science and Engineering (NSF 01-163)	NATO Postdoctoral Fellowship Program Division of Graduate Education National Science Foundation 4201 Wilson Blvd., Rm 907 Arlington, VA 22230 Tel: 703-292-8630 http://www.ehr.nsf.gov/dge/programs/nato/
International Research Fellowships (NSF 02-149)	International Research Fellowship Program Office of International Science and Engineering National Science Foundation 4201 Wilson Blvd., Rm 935 Arlington, VA 22230 Tel: 703-292-8711 http://www.nsf.gov/sbe/int/fellows/
Japan Society for the Promotion of Science (JSPS) Postdoctoral Awards for U.S. Researchers	JSPS Postdoctoral Awards Office of International Science and Engineering National Science Foundation 4201 Wilson Blvd., Rm 935 Arlington, VA 22230 Tel: 703-292-8704 e-mail: NSFJinfo@nsf.gov http://www.nsf.gov/sbe/int/

• Specialized Programs

Some NSF programs approach human resource and career development by addressing these issues across several education levels. This approach is used in activities aimed at improving the recruitment

and retention of women in careers in science and engineering and at realizing the potential for careers in science and engineering for persons with disabilities. Programs of this type include the following:

- Program for Gender Equity in Science, Mathematics, Engineering, and Technology
- Program for Persons with Disabilities

Facilitation Awards for Scientists and Engineers with Disabilities

The Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) encourages scientists and engineers with disabilities—including investigators and other staff, postdoctoral associates, student research assistants, and awardees and honorable mention recipients for graduate fellowships—to participate in NSF programs. These awards enable physically disabled persons to facilitate their work by providing funds for special equipment or for the assistance needed in conjunction with NSF-supported projects. A request for special equipment or assistance may be included in a new proposal submitted to any NSF program or in a request for a supplement to an existing NSF grant. Information is available in program announcement [NSF 02-115](#).

• Programs for Faculty and Institutional Development

One of NSF's core strategies is the integration of research and education. This strategy is embodied in NSF's premier program for early career faculty and in its presidential awards component. NSF also supports faculty members from predominantly undergraduate institutions by supporting their substantial contributions to research and education. Special research and education opportunities are available for these faculty as well as for faculty who are underrepresented minorities. Opportunities are available from NSF through the following programs:

1. [Faculty Early Career Development](#)
2. [NSF Component of the Presidential Early Career Awards for Scientists and Engineers](#)
3. [Research in Undergraduate Institutions and Research Opportunity Awards](#)
4. [Minority Research Planning Grants and Career Advancement Awards](#)
5. [ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers](#)
6. [Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring](#)

To ensure a broad national base for research, NSF emphasizes developing the research capacity of faculty across a range of institutions, including not only the predominantly undergraduate institutions previously mentioned, but also institutions that have had low participation in NSF programs in the past. The [Experimental Program to Stimulate Competitive Research \(EPSCoR\)](#) is an example of this emphasis.

The following are three examples of specialized programs aimed at the enhancement of research and education in minority-serving institutions:

- [Historically Black Colleges and Universities-Undergraduate Program](#)
- [Tribal Colleges and Universities Program](#)
- [Centers for Research Excellence in Science and Technology](#)

1. Faculty Early Career Development (CAREER)

The Faculty Early Career Development (CAREER) Program is an NSF-wide activity that supports junior faculty within the context of their overall career development. It combines in a single program research

support and education of the highest quality. CAREER emphasizes the importance NSF places on the early development of academic careers dedicated to stimulating the discovery process in which the excitement of research is enhanced by inspired teaching and enthusiastic learning.



For More Information

Visit the CAREER web site, <http://www.nsf.gov/home/crssprgm/career/>.

2. NSF Component of the Presidential Early Career Awards for Scientists and Engineers (PECASE)

Each year, NSF selects up to 20 nominees for PECASE. Nominees are selected from among the most meritorious new awardees supported by the Faculty Early Career Development (CAREER) Program (see description of CAREER above). The PECASE Program recognizes outstanding scientists and engineers who early in their careers show exceptional potential for leadership at the frontiers of knowledge. This presidential award is the highest honor bestowed by the U.S. Government on scientists and engineers who are beginning their independent careers.



For More Information

Information about PECASE, including eligibility factors and other pertinent information, is available on the PECASE web site, <http://www.nsf.gov/pecase/>.

3. Research in Undergraduate Institutions (RUI)

The Research in Undergraduate Institutions (RUI) activity supports research by faculty members from predominantly undergraduate institutions by funding (1) individual and collaborative research projects; (2) the purchase of shared-use research instrumentation; and (3) Research Opportunity Awards for work with NSF-supported investigators from other institutions (these three types of support are described below).

All NSF directorates participate in the RUI activity. RUI proposals are evaluated and funded by the NSF program in the disciplinary area of the proposed research. The objectives of RUI are to support high-quality research, strengthen the research environment in academic departments that are oriented primarily toward undergraduate instruction, and promote the integration of research and education.

The involvement of undergraduate students in a research-rich learning environment is an important feature of RUI. However, the primary purpose of RUI is to support faculty research, thereby maintaining the intellectual vibrancy of faculty members in the classroom and research community.

RUI provides the following types of support:

- **Individual-Investigator and Collaborative Faculty Research Projects**—Provides support through NSF research programs in response to proposals submitted by individual faculty members or by groups of collaborating investigators. RUI proposals differ from standard NSF proposals in that they include an RUI Impact Statement describing the expected effects of the proposed research on the research and education environment of the institution. Please note: the Directorate for Biological Sciences has special instructions for Collaborative Research at Undergraduate Institutions (C-RUI). See [NSF 02-020](#) for further details.
- **Shared Research Instrumentation and Tools**—Provides support for (1) the purchase or upgrade of instrumentation or equipment necessary to support research that will be conducted

by several faculty members and (2) the development of new instrumentation.

- **Research Opportunity Awards (ROAs)**—Enable faculty members at predominantly undergraduate institutions to pursue research as visiting scientists with NSF-supported investigators at other institutions. ROAs are usually funded as supplements to ongoing NSF research grants. ROAs are intended to increase visitors' research capability and effectiveness; improve research and teaching at their home institution; and enhance the NSF-funded research of the host principal investigator.

For More Information

For further information about the RUI activity, including guidelines for the preparation and submission of proposals, visit the RUI web site, <http://www.ehr.nsf.gov/crssprgm/rui/start.shtm>.

Prospective applicants for RUI grants and principal investigators interested in hosting an ROA visiting researcher are urged to contact a program officer in the appropriate discipline.

4. Minority Research Planning Grants and Career Advancement Awards

These awards are part of NSF's overall effort to give members of minority groups that are underrepresented in science and engineering greater access to science and engineering research and education support.

- **Minority Research Planning Grants (MRPGs)**—Enable principal investigators (PIs) who have not had prior independent Federal research support to develop competitive research projects by supporting preliminary studies and similar activities. These are one-time awards of up to \$18,000 for a maximum of 18 months.
- **Minority Career Advancement Awards (MCAAs)**—Support activities that can expand the research career potential of promising applicants. These awards are limited to approximately \$50,000 for 12 months and in general are one-time nonrenewable grants.

For More Information

The submission deadline date varies with each program. For additional information, contact the appropriate discipline. Information is also available in program announcement [NSF 94-147](#).

5. ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers

The ADVANCE Program seeks to improve the climate for women at academic institutions in the United States and facilitate the advancement of women to the highest ranks of academic leadership. The program seeks creative and sustainable approaches from women and men to meet these goals.

ADVANCE provides award opportunities for individuals and organizations through the following:

- **Fellows Awards**—Enable promising individuals to establish or re-establish full-time independent academic research and education careers in institutions of higher learning.
- **Institutional Transformation Awards**—Support academic institutional transformation to promote the increased participation and advancement of women scientists and engineers in academe.

- **Leadership Awards**—Recognize and encourage outstanding contributions of individuals, small groups, and organizations such as professional societies, with widespread impact on increasing the participation and advancement of women in academic science and engineering careers. These awards enable awardees to sustain, intensify, and initiate new activities designed to increase the participation and advancement of women scientists and engineers in academe.

Members of underrepresented minority groups and individuals with disabilities are encouraged to apply for an award. Proposals that address the participation and advancement of women from underrepresented minority groups are also encouraged.



For More Information

Visit the ADVANCE web site, <http://www.nsf.gov/home/crssprgm/advance/>.

6. Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM)

Administered by NSF on behalf of the White House, the PAESMEM Program seeks to identify outstanding mentoring efforts and programs that are designed to enhance the participation of groups traditionally underrepresented in science, mathematics, and engineering.



For More Information

See program announcement [NSF 02-063](#); or visit the PAESMEM web site, <http://www.ehr.nsf.gov/ehrd/paesmem.asp>.

• Programs for Groups Underrepresented in Science and Engineering

NSF has a number of special programs that address members of groups underrepresented in science and engineering. Activities are aimed at increasing the participation of underrepresented minorities (among minorities, these groups include American Indians/Alaska Natives [Native Americans], Blacks [African Americans], Hispanics, and Pacific Islanders); improving the recruitment and retention of women and girls in science and engineering careers; and ensuring that persons with disabilities have the opportunity to participate fully in NSF-supported projects. Such efforts include programs for students, faculty, and institutions designed to develop as fully as possible our Nation's talent pool.

The following is a list of these programs and activities, with reference to their accompanying publication, for further information.

Directorate for Biological Sciences (BIO):

- Minority Postdoctoral Research Fellowships and Supporting Activities ([NSF 00-139](#))

Directorate for Computer and Information Science and Engineering (CISE):

- CISE Minority Institutions Infrastructure ([NSF 96-15](#))
- Information Technology Research ([NSF 02-168](#))
- CISE Research Resources ([NSF 01-100](#))

Division of Human Resource Development (HRD), Directorate for Education and Human Resources (EHR):

- Alliances for Graduate Education and the Professoriate ([NSF 00-53](#))
- Centers of Research Excellence in Science and Technology ([NSF 98-19](#))
- Tribal Colleges and Universities Program ([NSF 02-019](#))
- Historically Black Colleges and Universities Undergraduate Program ([NSF 00-131](#))
- Louis Stokes Alliances for Minority Participation ([NSF 01-140](#))
- Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring ([NSF 01-54](#))
- Program for Gender Equity in Science, Mathematics, Engineering, and Technology ([NSF 01-6](#))
- Program for Persons with Disabilities ([NSF 01-67](#))

Directorate for Engineering (ENG):

- Biomedical Engineering and Research to Aid Persons with Disabilities ([NSF 01-12](#)). Direct inquiries to Dr. Gil Devey, Division of Bioengineering and Environmental Systems, National Science Foundation, 4201 Wilson Blvd., Rm. 565, Arlington, VA 22230; or contact by telephone, 703-292-8320.
- Supplemental Funding for Support of Women, Minorities, and Physically Disabled Engineering Research Assistants (see <http://www.eng.nsf.gov/eec/suppfund.htm>)

Directorate for Geosciences (GEO):

- Opportunities for Enhancing Diversity in the Geosciences ([NSF 01-36](#))

Directorate for Social, Behavioral, and Economic Sciences (SBE):

- Minority Postdoctoral Research Fellowships ([NSF 00-139](#))

Foundation-Wide Activities:

- Minority Research Planning Grants and Career Advancement Awards ([NSF 94-147](#)). All inquiries should be directed to the appropriate disciplinary program officer.
 - Facilitation Awards for Scientists and Engineers with Disabilities ([NSF 02-115](#))
 - ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers ([NSF 02-121](#))
 - Research Assistantships for Minority High School students (NSF 89-39)
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NSF CROSSCUTTING INVESTMENT STRATEGIES

Crosscutting Research, Instrumentation, and Partnering Programs

The programs and activities described in this section are as follows:

1. Grant Opportunities for Academic Liaison with Industry
2. Partnerships for Innovation
3. Innovation and Organizational Change
4. Global Change Research Program
5. International Science and Engineering
6. Small Business Innovation Research Program and Small Business Technology Transfer Program
7. Small Grants for Exploratory Research
8. Science and Technology Centers: Integrative Partnerships
9. Major Research Instrumentation
10. Collaboratives to Integrate Research and Education

1. Grant Opportunities for Academic Liaison with Industry (GOALI)

The Grant Opportunities for Academic Liaison with Industry (GOALI) Program aims to synergize university/industry partnerships by making funds available to support these linkages. The program supports (a) faculty, postdoctoral fellows, and students to conduct research and gain experience in an industrial setting; (b) industry scientists and engineers to bring industrial perspective and integrative skills to academe; and (c) interdisciplinary university/industry teams to conduct long-term projects.

The program targets high-risk and high-gain research, with focus on fundamental topics that would not otherwise have been undertaken by industry; the development of innovative, collaborative university/industry educational programs; and the direct exchange of new knowledge between academe and industry. GOALI provides (a) funding for individuals such as faculty, postdoctoral fellows, and students to develop creative modes of collaborative interaction with industry through individual or small-group research projects; and (b) industry-based fellowships for graduate students and postdoctoral fellows. All NSF Directorates participate in the GOALI Program at this time.



For More Information

See program announcement [NSF 98-142](#); or visit the GOALI web site, <http://www.nsf.gov/goali/>.

2. Partnerships for Innovation (PFI)

The PFI Program seeks to stimulate innovation by supporting partnerships among colleges and universities, State and local governments, the private sector, and other relevant organizations, thus emphasizing the productive connections between new knowledge created in the discovery process and learning and innovation.

For the purpose of this program, innovation explicitly extends to training and developing people and

tools and creating organizational conditions necessary to foster the transformation of knowledge into products, processes, systems, and services that will fuel economic development, create wealth, and generate improvement in the national standard of living. Key factors in the innovation enterprise include creating and accessing new knowledge, a scientifically and technologically literate workforce, and infrastructure that will enable innovation. Concurrently, the PFI Program addresses NSF's strategic intention to broaden participation of people and institutions in NSF activities.

The goals of the PFI Program are

- to catalyze partnerships for innovation that will enable the transformation of knowledge created by the national research and education enterprise into innovations that create new wealth, build strong local, regional, and national economies; and 2) improve the national well-being;
- to broaden the participation of all types of academic institutions and of citizens in NSF activities to better meet the broad workforce needs of the national innovation enterprise; and
- to create enabling infrastructure necessary to foster and sustain innovation for the long term.

Examples of proposals that might be submitted to the PFI Program are those that include planning and/or implementation of new models for innovation; education and training activities that explicitly address the workforce needs of the innovation enterprise; and development and deployment of new tools or mechanisms that support the innovation infrastructure. They may seek to create an activity focusing on a critical level of innovation in a technological area in an industrial sector or in a geographic region. The outcomes for proposed activities should foster economic and/or societal well being that can be self-sustaining in the long term. The lead organization must be a degree-granting academic institution of higher learning. At a minimum, proposed partnerships must include private-sector organizations or State/local government entities.



For More Information

A complete list of awards made by the program including project descriptions is available at <http://www.nsf.gov/od/lpa/news/press/00/pr0068.htm>. Further information is also available in program announcement [NSF 02-060](#). The PFI web site can be found at <http://www.ehr.nsf.gov/pfi/>.

3. Innovation and Organizational Change (IOC)

The IOC Program seeks to improve the performance of industrial, educational, service, health care, government, and other organizations and institutions through the support of research on theories, concepts, and methodologies of innovation and organizational change. To foster innovation and manage change, we need to understand effective approaches to organizational learning and redesign; strategic and cultural change; quality and process improvement; innovation; new product and service development; and the development and integration of new technologies. The program supports research using theory combined with empirical validation to clarify effective approaches to organizational learning and redesign; strategic and cultural change; quality and process improvement; innovation; new product and service development; and the development and integration of new technologies.

IOC is jointly sponsored by the Directorates for Social, Behavioral, and Economic Sciences; Engineering; and Education and Human Resources.



For More Information

Visit the program's web site at <http://www.nsf.gov/sbe/ses/ioc/>.

4. Global Change Research Programs (GCRPs)

NSF GCRPs support research and related activities that advance fundamental understanding of dynamic physical, biological, and socioeconomic systems as well as interactions among those systems. In addition to research on Earth system processes and the consequences of changes in those systems, NSF programs facilitate data acquisition and data management activities necessary for basic research on global change, promote the enhancement of modeling designed to improve representation of Earth system interactions, and develop advanced analytic methods to facilitate fundamental research. NSF also supports fundamental research on processes to identify and evaluate responses to changing global environmental conditions.



For More Information

A list of NSF-sponsored global change research programs and further information about each is available on the GCRP web site at <http://www.nsf.gov/geo/egch/>.

5. International Science and Engineering

Support of international activities is an integral part of NSF's mission to promote the progress of U.S. science and engineering. In particular, NSF recognizes the importance of (1) enabling U.S. researchers and educators to advance their work through international collaboration and (2) helping ensure that future generations of U.S. scientists and engineers gain professional experience overseas early in their careers. Consistent with the international character of science and engineering, disciplinary programs throughout NSF offer support to U.S. scientists and engineers for the international aspects of their research when those aspects are judged to be important to the specific objectives of those activities.

The Office of International Science and Engineering (INT), administratively located in the Social, Behavioral, and Economic Sciences Directorate, expands and facilitates the international dimensions of NSF's mission by promoting new partnerships between U.S. scientists and engineers and their foreign colleagues. Most programs in the international programs office are organized on a regional or country basis. Prospective applicants should also consider international opportunities supported by other parts of NSF and elsewhere.



For More Information

Information and guidelines on proposal preparation for international programs and activities are available in program announcement [NSF 00-138](#); or visit the INT web site at <http://www.nsf.gov/sbe/int/>.

6. Small Business Innovation Research Program and Small Business Technology Transfer Program

- **Small Business Innovation Research (SBIR) Program**—NSF encourages small businesses to submit high-quality proposals that focus on important science, engineering, and science/engineering education problems and opportunities and that will lead to significant commercial and public benefit. The SBIR Program is a Government-wide program intended to stimulate technological innovation, use small-business concerns to meet Federal research and development (R&D) needs, foster and encourage the participation of minority and disadvantaged persons in technological innovation, and increase the commercialization by the private sector of innovations resulting from Federal R&D.

SBIR uses a uniform three-phase process. Phase I is a 6-month effort designed to evaluate the feasibility of an idea based on its scientific and technical merit. Phase II builds on the feasibility study and leads to the development of a model or prototype. Phase III is the commercialization phase. Development of a partnership with another funding source is strongly encouraged and is one of the measures used in the evaluation of Phase II proposals. SBIR funds are not used for Phase III efforts.

SBIR is highly competitive and supports the Nation's small high-tech businesses, universities, and research institutions that are able to convert basic ideas and research into commercial products that will enhance the Nation's productivity and help maintain its competitive leadership in the international marketplace.

The small business can partner with other businesses or nonprofit institutions such as academic or Government laboratories. In Phase I, the partner's participation can be 33.3 percent, and in Phase II, up to 50 percent. Members of academic institutions can participate either through a subcontract to the institution or as consultants.



For More Information

Visit the SBIR web site at <http://www.eng.nsf.gov/sbir/>.

- **Small Business Technology Transfer (STTR) Program**—Also a Government-wide program, STTR differs from SBIR in that it requires the small business to engage in cooperative research with nonprofit research institutions. STTR is also a three-phase process. Phase I is a 12-month effort that determines scientific, technical, and commercial merit and establishes concept feasibility and eligibility for Phase II. Phase II further develops the proposed idea while taking into consideration scientific, technical, and commercial merit; Phase I results; and other relevant information. Phase III involves the commercial application of the research funded in Phases I and II. STTR funds are not used for Phase III efforts.

STTR is highly competitive and supports the Nation's small high-tech businesses, universities, and research institutions that are able to convert basic ideas and research into commercial products that will enhance the Nation's productivity and help maintain its competitive leadership in the international marketplace.

The small business must partner with a federally funded research and development center, university, or nonprofit institution. In both Phase I and Phase II, the participation must amount to a minimum of 40 percent of the effort for the small-business concern and 30 percent of the effort for the research institution. Members of the academic or research institution participate through a subcontract to the institution. Before starting Phase I, the partners make an agreement that covers rights to the technology involved in the proposal.



For More Information

Visit the STTR web site at <http://www.eng.nsf.gov/sbir/>.

7. Small Grants for Exploratory Research (SGER)

Proposals for small-scale, exploratory, high-risk research in the fields of science, engineering, and education normally supported by NSF may be submitted to individual programs. Such research is characterized as:

- preliminary work on untested and novel ideas;
- ventures into emerging research ideas;
- application of new expertise or new approaches to "established" research topics;
- having a severe urgency with regard to availability of, or access to data, facilities or specialized equipment, including quick-response research on natural disasters and similar unanticipated events; or
- efforts of similar character likely to catalyze rapid and innovative advances.

Investigators are strongly encouraged to contact the NSF program(s) most germane to the proposal topic before submitting an SGER proposal. This will facilitate determining whether the proposed work meets the guidelines described above and availability and appropriateness for SGER funding, or whether the work is more appropriate for submission as a fully reviewed proposal. The project description must be brief (two to five pages) and include clear statements as to why the proposed research should be considered particularly exploratory and high risk, the nature and significance of its potential impact on the field, and why an SGER grant would be a suitable means of supporting the work.

Brief biographical information is required for the PI and co-PI(s) only, and must list no more than five significant publications or other research products. The box for "Small Grant for Exploratory Research" must be checked on the proposal Cover Sheet.

These proposals will be subject to internal NSF merit review only. Renewed funding of SGER awards may be requested only through submission of a non-SGER proposal that will be subject to full merit review. The maximum SGER award amount will not exceed \$100,000. Although the maximum award amount is \$100,000, the award amount usually will be substantially less than a given program's average award amount. The project's duration will normally be one year, but may be up to two years.

At the discretion of the Program Officer, and with the concurrence of the Division Director, a small fraction of especially promising SGER awards may be extended for a period of six additional months and supplemented with up to \$50,000 in additional funding. The SGER award extensions will be possible for awards of two-year initial duration as well as for those of shorter initial duration. Requests for extensions must be submitted one to two months before the expiration date of the initial award. A project report and outline of proposed research, not to exceed five pages, must be included.

8. Science and Technology Centers: Integrative Partnerships (STC)

The STC Program was established in 1987 to fund important basic research and education activities and to encourage technology transfer and innovative approaches to interdisciplinary activities. Since its inception, thirty-six comprehensive STCs have been established.

The STCs explore new areas and build bridges among disciplines, institutions, and other sectors. They offer the research community an effective mechanism to embark upon long-term scientific and technological research activities, explore better and more effective ways to educate students, and develop mechanisms to ensure the timely transition of research and education advances made into service in society.



For More Information

Write to the Office of Integrative Activities (OIA), National Science Foundation, 4201 Wilson Boulevard, Rm 1270, Arlington, VA 22230; or contact by telephone, 703-292-8040, or by e-mail, nsf_oia@nsf.gov; or visit the OIA home page at <http://www.nsf.gov/od/oia/>.

9. Major Research Instrumentation (MRI)

The MRI Program is designed to improve the condition of scientific and engineering (S&E) equipment used for research and research training in our Nation's academic institutions. The program works to improve the quality and expand the scope of research and research training in S&E and foster the integration of research and education by providing instrumentation for research-intensive learning environments.

The MRI Program assists in the acquisition or development by U.S. institutions of major research instrumentation that is generally too costly to support through other NSF programs. Maintenance and technical support associated with these instruments is also supported. Proposals may be for a single instrument, a large system of instruments, or multiple instruments that share a common research focus. Computer systems, clusters of advanced workstations, networks, and other information infrastructure components necessary for research are supported.



For More Information

Write to the Office of Integrative Activities (OIA), National Science Foundation, 4201 Wilson Boulevard, Rm 1270, Arlington, VA 22230; or contact by telephone, 703-292-8040, or by e-mail, nsf_oia@nsf.gov; or visit the OIA home page, <http://www.nsf.gov/od/oia/>.

10. Collaboratives to Integrate Research and Education (CIRE)

The CIRE activity was created to establish long-term research and education relationships between minority-serving institutions and NSF-supported facilities and centers. CIRE's long-term goal is to formally establish these developing relationships by negotiating formal institution-to-institution agreements for their continuation and support. Examples of the types of activities supported by CIRE are (1) the development of collaborative and mutually beneficial research and education projects that may include infrastructure enhancement at the minority-serving institution, if needed, to support the proposed collaborative activity; and (2) exchanges of faculty and students. It should be noted however, that CIRE is not a general infrastructure program for minority-serving institutions. Funds to support CIRE-like activities come from the cognizant research directorate. Therefore, communication should be made with the Office of the Assistant Director of the cognizant directorate.



For More Information

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